

A review of the problem of protein-calorie deficiency disease in early childhood is presented. The need for numerical evidence on the extent of the disease is stressed, so that the vast dimensions of this problem can be more clearly envisaged. Methods for obtaining such data are critically discussed.

THE INCIDENCE OF PROTEIN-CALORIE MALNUTRITION OF EARLY CHILDHOOD

Derrick B. Jelliffe, M.D., F.R.C.P., F.A.P.H.A.

IN TROPICAL communities all over the world, it has become widely recognized in the last two decades that what has been termed "protein-calorie malnutrition of early childhood"¹ is the most common and most serious form of dietary disease.

Value of Concept—The usefulness of employing the group designation "protein-calorie malnutrition of early childhood" is that it covers the various syndromes that may result, including kwashiorkor, incomplete kwashiorkor, nutritional marasmus, and unclassifiable intermediate clinical pictures, as well as such lesser manifestations as growth retardation in the transitional period,* often in the second year of life. All these are related to protein lack, but with varying associated intakes of calories in the form of carbohydrates.

The term also emphasizes that kwashiorkor is not the only clinical picture resulting from severe protein deficiency (in fact, nutritional marasmus is more common in some areas) and also stresses

the need for calories both in tropical infant feeding and in the treatment of protein-calorie malnutrition syndromes.³

Forms of Protein-Calorie Malnutrition of Early Childhood—Although the syndrome known as kwashiorkor has understandably received most attention, it is only one severe manifestation of this type of malnutrition. In fact, the following common disease entities can often be differentiated, although equally it is not possible to fit all affected children into scientifically precise diagnostic pigeonholes.

Kwashiorkor—The basic clinical features of kwashiorkor are edema, growth retardation (as shown by a low body weight), wasted muscles with some, or even a thick layer, of overlying subcutaneous fat, and psychomotor change. Other manifestations vary in different parts of the world and can be divided for each region into (a) those usually present, and (b) those occasionally so.⁴ Kwashiorkor usually has its peak incidence between one and two years of age, and, although medical, social, and cultural conditioning factors are also always operative, the primary cause is a diet low in protein, but containing some, or even substantial, calories in the form of carbohydrate foods.

"Incomplete" or "Early" or "Pre-"

* The term "transitional period" refers to the sometimes prolonged nutritional interval between the time when the infant is adequately fed with breast milk alone and the time when the child is having the full adult diet alone. It avoids the use of the word "weaning," which is, in fact, employed loosely with various meanings by different authors.²

or "Mild" Kwashiorkor—This form of protein-calorie malnutrition is easier to recognize clinically than to define with precision. The child will be underweight with wasted muscles in the presence of subcutaneous fat. Some of the other variable features of kwashiorkor are often present, including hair changes, liver enlargement, and so on. The etiology is the same as in classical kwashiorkor. Possibly some affected children recover from this phase, while others will be precipitated into frank kwashiorkor by an intercurrent infection or some other conditioning factor.

Nutritional Marasmus—The cardinal features of this syndrome are extreme growth retardation (as shown by a very low body weight) and wasted muscles associated with poor subcutaneous fat. Edema is not present. The child is often below one year of age. The etiology is a diet low in both protein and calories, often resulting from the too early cessation of breast feeding, associated with attempted bottle feeding with overdilute, contaminated mixtures. Infective diarrhea is, therefore, a frequent conditioning factor, so that dehydration is commonly also present.

Transitional Growth Failure ("Growth Crisis of Weaning")⁵—Probably the most common form of protein-calorie malnutrition in early childhood is the growth failure shown by the flattening of the weight curve, which in many tropical regions may affect the majority of children to a lesser degree in the second semester of life and most markedly in the dangerous one- to three-year period. There may be other suggestive signs, such as some degree of apathy, poor musculature, and hair changes.⁴

Once again, but in a less severe degree, a poor intake of calories, especially protein in a predominantly carbohydrate diet, seems mainly responsible, although infective and parasitic factors also play a part.

In addition, in tropical regions young

children are seen not rarely who are extremely small for their age, but whose body proportions are not markedly abnormal, although their heads are not very small when measured.⁶ In particular, the ratio between their body muscle and subcutaneous fat appears clinically to be roughly within normal limits. This rather ill-defined clinical entity has been termed "nutritional dwarfing,"¹ and it may be postulated that this is the result of what can be termed a "balanced" subnutrition, in which both protein and calories are moderately deficient so that, although gross malnutritional disease does not occur, the child does not receive sufficient for normal growth and dwarfing occurs during early childhood.

Methods of Assessment

While increasing evidence from most parts of the tropics has shown that kwashiorkor is widely distributed and is an important hospital problem, few co-ordinated attempts have been made to assess the public health importance of the wider aspects of protein-calorie malnutrition in early childhood, including the other major syndromes and the much more common—but less easily demonstrable—less gross manifestations.

Statistics showing the incidence of protein-calorie malnutrition have, as will be noted later, more than academic value, and information needs to be sought from two sources: (1) special centers, and (2) community studies.

Special Centers

Hospitals—Although a biased sample, the percentage of pediatric admissions and outpatients with protein-calorie malnutrition will give crude information as to whether severe forms, especially kwashiorkor and nutritional marasmus, are common or not. However, as usual with this type of data, many factors may influence the figures, such as the local

acceptability of hospital treatment, the number of children's beds, the area and population drained, whether kwashiorkor is recognized by villagers as responding to modern therapy, and how children with the multiple diseases, which are the rule, are "classified" by hospital staff. Again, if autopsies are obtainable, the percentage of these with kwashiorkor and nutritional marasmus will give some gauge of their importance as killing diseases, as well as highlighting inadequacies of treatment.

It is certainly of value to ensure that the recognition of kwashiorkor and nutritional marasmus is understood by hospital staff, and attendances recorded and collected at intervals by the central health authorities, together with other hospital statistics. However, as noted, great care is required before any inference is drawn from these figures, and especially in minor changes from year to year.

Dispensaries, Health Centers, Child Welfare Clinics—In most tropical regions, a network of dispensaries or health centers is in the process of development, aiming ultimately at covering the country concerned. They are often run by junior staff under difficult circumstances. Nevertheless, it is desirable to train these personnel at least to recognize typical kwashiorkor and nutritional marasmus, so that yearly percentages of all pediatric attendances (or of preschool-age children) with these conditions can be known. Once again, however, care is needed in interpreting statistics based on these biased samples of sick children.

In more equipped child welfare clinics, serial weight recordings may be kept. If so, the percentage of children with significantly flattened weight curves—or with other "nutritional indicators" listed later—during the critical one- to three-year period would give an indication of lesser degrees of protein-calorie malnutrition.

Vital Statistics—In most tropical countries, especially in rural areas, records of births and deaths are imperfect or, quite frequently, nonexistent. However, in regions, such as the West Indies, where the need for these records has come to be accepted by the population and are reasonably accurate, it has been suggested by Wills and Waterlow that the one- to four-year-old mortality rate can sometimes be used as an index of the public health significance of protein-calorie malnutrition, even in the absence of details of the actual causes of death.⁷

The usefulness of this concept in suitable circumstances has received support from Harney, working in the Caribbean Island of St. Kitts, who showed that the one- to four-year mortality rate fell from between 2.4 and 4.5 in 1950-1953 to between 1.1 and 1.6 in 1954-1956, when the only apparent change was the introduction of supplementary protein in the form of dried skimmed milk.⁸

Community Studies

The only accurate method of assessing the prevalence of protein-calorie malnutrition in the community is by carrying out a field survey in which all the children at risk—usually in the first four years of life—are examined in a circumscribed area.⁹

Practical difficulties are usually considerable, especially administrative and organizational problems. Suitable statistically valid sampling should be aimed at, but may be difficult to achieve. Work will always have to be carried out in collaboration with local leaders, such as the chiefs in Africa. Parents will have to be motivated to ensure cooperation, usually by the provision of treatment for ill children.

If villages or similar aggregations exist, these form convenient survey units. In parts of the world where houses are widely scattered, as in East Africa, it is necessary either to carry out house-to-house visits, which are always time-

consuming and may be impossible geographically, or to arrange for the collection of all the children of the area at a suitable place, a difficult matter to ensure with certainty.

Disadvantages of this type of field study are that it consumes a great deal of time of trained staff, it usually only reflects the situation at the particular season (that is the prevalence), and, if the region varies from district to district, the results may only apply to a limited locality.

Indicators of Protein-Calorie Malnutrition—Under field circumstances simple methods have to be used to assess how common protein-calorie malnutrition is in the community.

(1) **Syndromes**—Clear-cut syndromes of protein-calorie malnutrition will be recorded, although in practice it will be found that only kwashiorkor and nutritional marasmus can be defined with sufficient precision to be included.

(2) **Nutritional Indicators**—Attempts have been made to use various clinical signs as nutritional indicators in a similar way to the splenic index in malaria survey work. Unfortunately, there are none which are completely satisfactory owing to the different clinical picture in different forms of protein-calorie malnutrition, the lack of constancy of many features even in such advanced syndromes as kwashiorkor, and the difficulty in making an objective definition and quantitative measurement of many signs (i.e., *apathy*).^{9, 10}

The preschool-age edema index has been used extensively, but only gives information on one gross aspect of the problem.¹¹⁻¹³ Hypochromotrichia, as judged by light-colored hair affecting at least one-quarter of the hair length and all the scalp, may be useful, perhaps especially in children of African descent.^{9, 10} A low arm circumference, reflecting as it does a poorly developed or wasted arm musculature, has been suggested as an index, but is difficult to define and requires a local standard

and accuracy in age estimation. These signs have, however, the virtue of simplicity.^{9, 10}

Other features to be suggested have included easily pluckable hair,¹⁰ "moon-face," hepatomegaly, skin color, demeanor, and so on. They all have the disadvantage of being difficult to quantify objectively.⁹

(3) **Laboratory Tests**—These have not achieved a prominent place in community surveys for protein-calorie malnutrition of early childhood because of difficulty of collection in rural areas and also because of uncertainty as to interpretation of results so laboriously acquired. The total plasma protein, or preferably albumen, levels have been advocated. Analyses of hair samples for physical characteristics, such as tensile strength, and for biochemical changes (especially a low cystine content) have been suggested, but require much further detailed research.¹⁰

(4) **Weight**—It is agreed that growth retardation, as reflected by failure of weight gain or by loss of weight, is a cardinal feature of protein-calorie malnutrition. Weighing children in field surveys has, then, an obvious application, especially in view of the simple apparatus needed.

The world-wide difficulties in rural tropical regions are age estimation and local standards. Only in exceptional circumstances is documentary proof of age available in the form of a birth certificate, or horoscope, as in India. Estimates of age can then be attempted by various means; probably the least unreliable is by means of a locally constructed calendar of seasonal agricultural and meteorological events and of man-made and natural unusual events—which are only too often disasters.

A local standard is necessary, but if not available it may be necessary to use the most suitable substitute (i.e., of Jamaican children for Haiti), or, at worst, employing some recognized world standard, such as that found in Nelson's

"Textbook of Pediatrics." In fact, it may be better, even if a local standard is available, to compare results with it and also with an internationally recognized yardstick.

Various methods of comparison are possible, such as using percentiles. However, despite disadvantages, the Gómez classification has a practical usefulness. In this, weight results are expressed in terms of "normal"—over 90 per cent of the average; first degree malnutrition—below 90-75 per cent; second degree—below 75-60 per cent; third degree—below 60 per cent.¹⁴

Combined Methods—The status of a community in relation to protein-calorie malnutrition of early childhood is easier to assess the worse the situation. It is possible that for general use in many tropical regions some form of combined or composite index might be evolved, based on, say, syndrome prevalence, weight distribution by Gómez classification, and the edema, hypochromotrichia, and low arm circumference indexes.

Ecologic Surveys—Field surveys intended to give information on the public health significance of protein-calorie malnutrition of early childhood in the community are difficult to organize and time-consuming—both in execution and in time spent on analysis.⁹

As this type of malnutrition is rarely exclusively dietetic, it is sound policy to make each field survey an ecologic study of child health. The aim should always be to obtain the maximum amount of useful information in relation to possible conditioning factors in the least time and with the minimum staff, and to bring as many specimens as possible back for examination at leisure rather than dealing with them inadequately with poor facilities in the field.

In a series of Community Studies of Child Health in East Africa,¹³⁻¹⁶ the following are carried out, apart from the nutritional examination already outlined: (1) clinical picture (including

skin disease); (2) thick blood film (malaria); (3) hemoglobin (in Drabkin's solution as preservative for colorimetric examination later); (4) stool (taken by the anal-tube technic and preserved in 10 per cent formol-saline); (5) approximate dietary histories, which, without being accurate, can often permit a rough knowledge of principal local practices and relevant cultural attitudes.

In addition, field studies must always include as much as practicable in the way of home visiting and of expeditions to the local markets and to cultivation areas in order to assess the local availability and cost of foodstuffs, culinary possibilities, and other aspects of practical home economics.

Magnitude of the Problem

Very few parts of the world have statistics showing the actual incidence of all forms of protein-calorie malnutrition of early childhood, as judged by combined statistics obtained from hospitals, health centers, child welfare clinics and community studies, and, what is more, it is most difficult to compare results from one country to another as quite often different definitions and standards have been used. However, where even some of these figures are available, they often plainly indicate a public health problem of huge dimensions, as shown by the following examples from widely separated regions of the world.

West Indies

The only West Indian territory to have had a country-wide protein-calorie malnutrition survey is the Republic of Haiti. The country is impoverished, overpopulated, and has negligible health services in the mountainous majority of the country, in which even road communications are rudimentary. The community survey carried out in 1958 showed for the country as a whole a 7 per cent kwashiorkor rate among one

to three year olds; results in different regions ranged from 3 to 16 per cent.^{11,12} This very high over-all rate meant that at the time of the survey one out of 14 children of this age group were suffering from actual kwashiorkor. However, of more significance as a gauge of the magnitude of the problem were over-all results based on syndromal assessment, nutritional indicators, and weight levels which suggested, in fact, that two-thirds of the one- to three-year-old population were suffering from some degree of protein-calorie malnutrition.^{11,12}

Asia

Two surveys may be quoted from Asia. The first was a country-wide study in 1955 by Dean in which approximately 6 per cent of 3,145 Malayan children aged between one and four years examined in their kampongs were found to have kwashiorkor. The worst affected district was Perak in which over one-fifth of all preschool children were found to show the signs of kwashiorkor.^{17,18} A subsequent survey of Perak district by Thomson has again shown protein-calorie malnutrition to be common among one to five year olds; 19 per cent showing kwashiorkor, and 25 per cent "pre-kwashiorkor."¹⁹

In India, Someswara Rao and his colleagues have carried out a very widespread investigation in the four southern states of Madras, Andhra Pradesh, Mysore, and Kerala.²⁰ It was found that between 5 and 16 per cent of pediatric admissions to hospital were made because of frank kwashiorkor; while village studies based on large-scale home sampling showed that among children aged up to five years about 1 per cent had kwashiorkor and 1.7 per cent marasmus. As the authors note, since there are approximately 12 million children of this age range in southern India, this would mean that at the time of the survey there were some 120,000 untreated children with kwashiorkor, apart

from other manifestations of protein-calorie malnutrition.

Africa

Examples may be quoted from the Central African country of Uganda in which work has been carried out into the problems of protein-calorie malnutrition for the last 20 years, especially in the Province of Buganda, in which the capital, Kampala, is situated.

Buganda—In the 1940's and later, Trowell drew the attention of the scientific world to the commonness in this part of the world of what was then called "Malignant Malnutrition"²¹; in 1948, Davies reported that in approximately 70 per cent of consecutive autopsies on young children carried out at Mulago Hospital, malnutrition was the main or a significant contributory cause.²²

In the pediatric unit at the same hospital, which admits children only up to about six years of age, in 1950-1951 there were 9 per cent admissions with kwashiorkor and 1.7 per cent with marasmus²³; while in 1959 Latimer Musoke found 10 per cent and 4 per cent in the same categories.²⁴ From figures collected for 1960 from all hospitals in the Kampala area, Burgess has calculated that kwashiorkor makes up 0.4 per cent of total outpatients and 1.3 per cent of total inpatients of all ages.²⁵

At child welfare clinics in Buganda, Welbourn has shown that, in fact, probably at least 50 per cent of African children aged between six months and three years pass through a phase of protein-calorie malnutrition of some degree of severity. The mildly affected showed only weight retardation, changes in hair color and texture, and difficult-to-measure changes in demeanor. In addition, about 4 per cent of one to three year olds attending these clinics showed edema.²⁶

During the year 1956, special record forms were used in rural dispensaries in various parts of the country. In the

Mengo District of Buganda, analysis of results showed that 12.8 per cent of one to three year olds attending had kwashiorkor; while 8.4 per cent of all ages attending showed marasmus.²⁷

Rest of Uganda—Statistics from other parts of the country show great variation, as judged by hospital admissions and outpatient figures, attendances at dispensaries, and several community surveys. This is to be expected as there are major ecological differences within the country, including staple foods, infant rearing practices, and the incidence of conditioning diseases, such as malaria and various intestinal helminths.¹³⁻¹⁶

Burgess has calculated the percentage of cases of kwashiorkor out of the total admissions to hospitals in 1960 in different regions of Uganda and has shown that this varies from nil among the cattle-keeping Karamojong of the north to 3.6 per cent in overcrowded plantain-eating Bukedi,²⁵ although these figures are difficult to compare owing to differences in hospital facilities, communications, and levels of "development."

Similarly, Gongora and McFie's dispensary figures for 1956 varied from 4.3 to 19.6 per cent for kwashiorkor (in one to three year olds) and from 3.1 to 11.3 per cent of marasmus out of total attendances.²⁷

In addition, field studies carried out recently among the Bachiga in a rural part of Kigezi, the Acholi and the Lugbara showed little severe protein-calorie malnutrition to be present, although minor forms were more frequent.¹⁴⁻¹⁶

Discussion

Probably the first requisite toward appreciating the public health significance of protein-calorie malnutrition of early childhood is the realization that much more than kwashiorkor has to be considered. The other severe manifestations, especially nutritional marasmus, have to be included in addition to less

clinically definite "intermediate" syndromes and, perhaps especially, the much greater numbers with mild-moderate disease,⁴ including transitional growth failure and probable increased susceptibility to intercurrent infection.

Protein-calorie malnutrition of early childhood occurs commonly in most tropical countries, and in some it may, in fact, be the principal public health problem, although often not recognized as such. Indeed, it will be necessary to have much improved information before definite figures can be produced to show its full magnitude, and these will have (a) to recognize the full clinical range of protein-calorie malnutrition, and (b) to be based, if possible, on combined results from hospitals, dispensaries, child welfare clinics, and vital statistics, as well as actual community surveys. In this regard, there is much need for international guidance in order to produce data comparable from one region to another. For example, at present, cases of kwashiorkor admitted to hospitals may, in different parts of the world, be expressed as percentages of total admissions of one to three year olds or of children under five years. Different definitions of kwashiorkor may be used from one region to another. Degrees of flattening of weight curves, gathered in child welfare clinics, possibly significant of protein-calorie malnutrition need definition and standardization.

Information is required from all available sources on an ecologic regional basis, as it will be found that the incidence of this type of condition varies from one part of a country to another. For example, in Uganda as a whole, kwashiorkor cases made up 1.3 per cent of total hospital admissions, whereas detailed consideration by districts showed a variation from 0.1 per cent in Teso to 3.6 per cent in Bukedi.²⁵

The importance of ecologic field surveys must also be stressed, because, as

well as indicating the prevalence of gross protein-calorie malnutrition, they also give the useful approximate information concerning lesser states of malnutrition and indicate the various infective, parasitic, psychosocial, and cultural factors that may be operating as significant conditioning events.

Conclusion

Only by the improved gathering of information both concerning advanced cases in hospitals and dispensaries, and also concerning less severely affected children attending welfare clinics and in the actual community, can the full extent of the problem be exposed.

Only in this way can preventive measures be rationally applied to most needy areas within a country,* and the results of these schemes later evaluated.

In particular, numerical evidence, even of an approximate nature, is needed rather than impressions to make clear to the fund-controlling public health administrators and politicians the vast size of the problem of protein-calorie malnutrition of early childhood, which in some parts of the world affects in some degree half, or even all, the preschool child population.

* For example, attempts have been made in Uganda to construct a "protein need index" for different parts of the country to aid in the most equitable and useful distribution of dried skimmed milk powder throughout the country. This index is based on a formula taking into account the amount of protein-calorie malnutrition (as judged by hospital and dispensary figures), the population under six years, and the facilities available for distribution.²⁵

REFERENCES

1. Jelliffe, D. B. Protein-Calorie Malnutrition in Early Childhood. *J. Pediat.* 52:227, 1959.
2. ———. Culture, Social Change in Infant Feeding. *Am. J. Clin. Nutr.* 10:19, 1961.
3. Dean, R. F. A., and Skinner, M. A Note on the Treatment of Kwashiorkor. *J. Trop. Pediat.* 2:215, 1957.
4. Jelliffe, D. B., and Welbourn, H. F. Proceedings of Båstad Conference, 1962. Clinical Signs of Mild-Moderate Protein-Calorie Malnutrition of Early Childhood. Swedish Nutrition Foundation, 1963.
5. Dean, R. F. A. (Personal communication, 1961.)
6. Welbourn, H. F. (Personal communication, 1961.)
7. Wills, V. G., and Waterlow, J. C. The Death Rate in the Age-Group 1-4 Years as an Index of Malnutrition. *J. Trop. Pediat.* 3:167, 1958.
8. Harney, L. The Effect of Additional Dietary Skimmed Milk on the Nutrition of Children of the Colony of St. Kitts-Nevis-Anguilla, Using Deaths from 1-4 Years as Indicator. *West Ind. M. J.* 7: 211, 1958.
9. Jelliffe, D. B., and Jelliffe, E. F. P. Proceedings of Båstad Conference, 1962. The Assessment of Protein-Calorie Malnutrition of Early Childhood as a Community Problem. Swedish Nutrition Foundation, 1963.
10. Bengoa, J.; Jelliffe, D. B.; and Perez, C. Some Indicators for a Broad Assessment of the Magnitude of Protein-Calorie Malnutrition in Young Children in Population Groups. *Am. J. Clin. Nutr.* 7:714, 1959.
11. Jelliffe, D. B., and Jelliffe, E. F. P. The Prevalence of Protein-Calorie Malnutrition in Haitian Preschool Children. *A.J.P.H.* 50:1355, 1960.
12. ———. The Nutritional Status of Haitian Children. *Acta trop.* 18:1, 1961.
13. Jelliffe, D. B.; Bennett, F. J.; Stroud, C. E.; Novotny, N.; Karrach, K.; Musoke, L.; and Jelliffe, E. F. P. The Health of Bachiga Children. *Am. J. Trop. Med.* 10:435, 1961.
14. Jelliffe, D. B.; Woodburn, J.; Bennett, F. J.; and Jelliffe, E. F. P. The Children of the Hadza Hunters. *J. Pediat.* 60:907, 1961.
15. Jelliffe, D. B.; Bennett, F. J.; Stroud, C. E.; Welbourn, H. F.; and Jelliffe, E. F. P. The Health of Acholi Children. *Trop. Geogr. Med.* (In press, 1963.)
16. Jelliffe, D. B.; Bennett, F. J.; White, R. H.; Cullinan, T. R.; and Jelliffe, E. F. The Children of the Lugbara. *Trop. Geogr. Med.* 14:33, 1962.
17. Dean, R. F. A. Kwashiorkor in Malaya. *World Health Organ.* 20:727, 1959.
18. ———. Kwashiorkor in Malaya: The Clinical Evidence. Part 1. *J. Trop. Pediat.* 7:3, 1961.
19. Thomson, F. A. Child Nutrition: A Survey of Perak District of Malaya. *Bull. Inst. Med. Res. Fed. Malaya.* No. 10, 1960.
20. Rao, S.; Swaminathan, M. C.; Swarup, S.; and Patwardhan, V. N. Protein Malnutrition in South India. *Bull. World Health Organ.* 20:603, 1959.
21. Trowell, H. C. A Note on Infantile Pellagra. *Tr. Roy. Soc. Trop. Med. & Hyg.* 35:13, 1941.
22. Davies, J. N. P. Pathology of Central African Natives: Mulago Postmortem Studies VII. *East African M. J.* 25:228, 1948.
23. ———. Children's Diseases at Mulago Hospital 1950-51: An Analysis of the Causes of Admission. *Ibid.* 32:283, 1955.
24. Musoke, L. K. Analysis of Admissions to the Paediatric Division. *Mulago Hospital, 1959. Arch. Dis. Childhood* 36:305, 1961.
25. Burgess, H. L. (Personal communication, 1961.)
26. Welbourn, H. F. Signs of Malnutrition Among Buganda Children Attending Child Welfare Clinics. *East African M. J.* 31:332, 1954.
27. Gongora, J., and McFie, J. Malnutrition, Malaria and Mortality. The Use of a Simple Questionnaire in an Epidemiological Study. *Tr. Roy. Soc. Trop. Med. & Hyg.* 53:238, 1959.

Dr. Jelliffe is professor of pediatrics and child health, Makerere Medical School, University of East Africa, Kampala, Uganda, East Africa.

This paper was presented at the Tenth Pacific Science Congress, Hawaii, August, 1961.